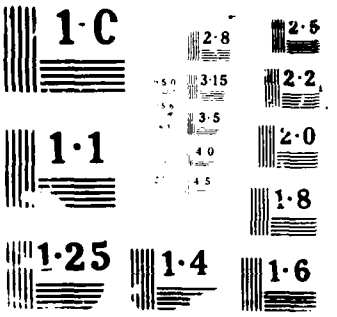
AD-A191 423 MBE OF HGCDTE(U) CAMBRIDGE UNIV (ENGLAND) CAVENDISH LAB 1/1
T D COLDING 1987 DAJA45-87-C-0033

UNCLASSIFIED F/G 20/12 NL


1·C
2·8
2·5
3·15
2·2
3·5
1·1
2·0
4·0
4·5
1·8
1·25
1·4
1·6

(2)

MBE OF HgCdTe

Principal Investigator: T.D. Golding

Contractor: Cambridge University, England

Coordinators: Dr. J. Dinan - Night Vision & Electro-Optics Center
Fort Belvoir, VA

Dr. M. Pepper - Cavendish Laboratory
Cambridge University

A-1

The research reported in this document has been made possible through the support and sponsorship of the U.S. Government through its U.S. Army Research and Standardization Group (Europe). ~~This report is intended only for the internal management use of the contractor and the U.S. Government.~~

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

FIRST INTERIM REPORT

During the present reporting period a feasibility study of InSb/CdTe superlattices and InSb/CdTe/InSb barrier systems for study of vertical transport properties has been conducted. Auger depth profiles of four-period InSb/CdTe (200/200A) SL grown at 300, 200, and 75°C indicate severe interdiffusion and/or growth problems with this system (Figs 1, 2, and 3). CdTe can be successfully grown within the temperature range 180-300°C. InSb is typically grown between 300-400°C. Thus at present the overlap in the InSb and CdTe growth temperature windows is around 300°C. It is also apparent that there is very little incorporation of Cd. This is believed to be a consequence of the growth mechanism during the growth of an InSb/CdTe SL whereby the Te bonds with In resulting in Cd deficient layers. (See Table 1 (i)). Once the available In has bonded with the Te stoichiometric CdTe will then prevail. It is apparent that in order to obtain abrupt InSb/CdTe heterojunctions a full study of the parameters during growth will have to be examined. One possibility is the growth of the CdTe layers using Cd overpressures to force incorporation of Cd. Another is to place a monolayer of Te down following the growth of the InSb to bond with the available/active In and thus suppress disruption of the subsequent CdTe layer.

There is evidence to suggest that In_2Te_3 is one of the compounds formed at the InSb/CdTe interface (ii). In_2Te_3 is a zinc blend defect type semiconductor with a bandgap of around 1eV and lattice mismatch with InSb of about 5%. The Night Vision MBE has In and Te cells.

With this unique combination In_2Te_3 has been grown at substrate temperatures compatible with InSb/CdTe SL (300°C). To our knowledge this is the first MBE In_2Te_3 growth reported. It is now possible to examine the feasibility of In_2Te_3 as a diffusion barrier placed between the InSb and CdTe layers. We are at present in the process of characterizing InSb/In_2Te_3/InSb structures for interdiffusion effects. Preliminary work seems very encouraging. This will take us to the possibilities of studying InSb/In_2Te_3 systems for quantum tunneling and Stained Layer Superlattices.

(i) B. Legendre, B. Gather, and R. Blachnik, Z. Metallkd. 71 588 (1980).

(ii) K.J. Mackey, D.R.T. Zahn, P.M.G. Allen, R.H. Williams, and W. Richter, J. Vac. Sci. Technol. B5(4), 1233 (1987).

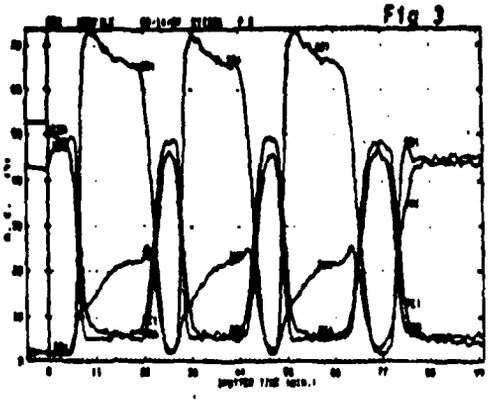
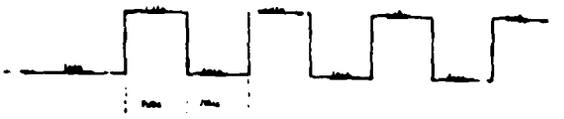


Fig 3

Ideal structure of InSb/CdTe system used for Auger profiles



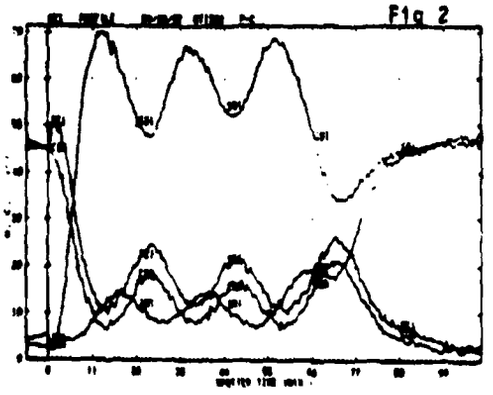


Fig 2

Auger depth profiles of InSb/CdTe (200/200A) SL grown at 300, 200 and 75°C. (Figs 1,2, and 3 respectively)

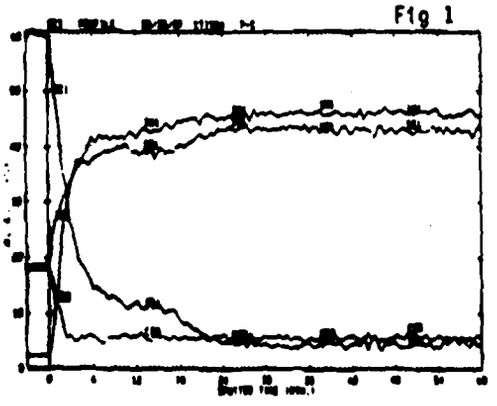


Fig 1

TABLE I Heats of formation

Compound	H (kcal/mol)
CdTe	− 24.3
In_2Te	− 19.0
InTe	− 17.2
In_2Te_3	− 45.8
In_2Te_5	− 49.8
InSb	− 7.5
Sb_2Te_3	− 13.5
CdSb	− 3.3
Cd_3Sb_2	− 8.0

END

DATE
FILMED

588